Drought Analysis and Properties by Stochastic Methods

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Abstract. Planning and management of extreme events such as droughts are important tasks for federal, state and local governments. Planning generally addresses the question of securing adequate water supplies in the area of concern considering the potential water demands for a certain planning horizon. In addition, it includes planning a number of contingency and emergency measures that water administrators and water users must take during the evolution of droughts that might occur in the future (planning horizon). On the other hand, management of extreme droughts refers to the combination of measures that must be taken during impending and ongoing droughts.

Clearly both planning and management measures involve certain degree of uncertainty and risk because both water supplies and water demands have inherent components of randomness some of which are related to spatial and temporal hydro-climatic variability. Hence, necessarily both drought planning and management activities must involve predicting potential droughts and forecasting the evolution of ongoing droughts.

In this presentation we will focus on drought analysis, e.g. determining drought properties based on stochastic approaches. More specifically, we are interested on estimating such properties as the likelihood of the occurrence of droughts of a given duration, say 6-years duration, the return period of droughts of 6 or more years of duration, and the risk that in a given planning horizon, say 50 years, we will have droughts of 6-years duration or longer. In addition, we will discuss empirical, simulation, and analytical techniques that may be useful for estimating such drought properties and particularly vulnerability of water resources systems to droughts of different lengths and types. We will illustrate some of them by using precipitation and streamflow data of the State of Colorado.